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DOES CANOEING INCREASE STREAMBANK EROSION?

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ABSTRACT.--Describes research on the Pine River in Michigan to determine if large increases in canoeing accelerated streambank erosion. Most erosion was natural but people sliding and camping on streambanks created some erosion. Heavy canoe traffic was not a cause of erosion.

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Canoeing is a popular and rapidly increasing sport. On the Pine River, one of the more heavily canoed streams in northern Michigan, the number of people "floating" the river has increased from an estimated 13,000 in 1966 to 64,000 in 1973. The Pine River has many eroding banks, a condition common along many other Michigan streams. It has been alleged that heavy canoe traffic will accelerate streambank erosion. This paper presents relevant data from the Pine River and discusses their implications.

METHODS

In 1966, all the eroding streambanks along the lower 26 miles of the Pine River were identified and categorized in terms of bank size, soil type, and the percent of bank waterline that was vegetated. An eroding bank was defined as an area of bare soil greater than 50 square feet, some of which was at the waterline. More than 200 such banks were located, 48 of which were randomly selected and photographed in 1967. In 1973 the same 200 banks were again categorized using the original criteria, and the 48 banks with a photo record were observed with photo-in-hand and judged as to whether waterline vegetation was more, less, or the same as before. These judgments were made independently by two observers. Concurrent streambank erosion surveys on the same photographed banks showed that the percent of waterline bare of vegetation was a good indicator of erosion (Hansen 1971).

RECENT STREAM CHANGES

Streambank stabilization about 20 years ago on seven banks in the study area had an insignificant effect on this study. Two changes occurred during the 8-year study period that could conceivably increase streambank erosion: an increase in stream discharge and flood peaks, and a large increase in canoeing.

Hydrologic Changes

Stream discharge records on the Pine River began in 1952 (U.S. Geological Survey 1961-73, 1964). The higher than normal discharge experienced during the study period are apparently due to regional climatic fluctuation as evidenced by the present record high water surface elevation of the Great Lakes. Five of the six greatest average annual discharges occurred since 1966, and summer floods were also much more frequent (table 1). Annual flood peaks were normal, however.

Table 1.--*Stream discharge data ordered by decreasing amounts for 21 years of record.*[1]

(In $ft^3/sec.$)

Average annual discharge	Annual peak discharge	All summer peaks greater than 650 ft^3/sec
326 (1967)	2,440	2,440
316 (1969)	1,970 (1971)	1,236 (1969)
311	1,430	1,142 (1969)
307 (1971)	1,380	1,142 (1969)
302 (1966)	1,280 (1967)	835
296 (1970)	1,236 (1969)	834 (1970)
294	1,140	814
293	1,130	767 (1970)
286	1,040	748 (1967)
285 (1968)	950	746
284 (1973)	928 (1966)	660
280	908 (1972)	
276	860	
273 (1972)	834 (1970)	
268	773 (1968)	
260	764	
258	760	
255	741 (1973)	
252	662	
241	658	
233	620	

[1]Study years in parentheses.

Changes in Canoeing

Canoeing increased five-fold between 1966 and 1973. In 1973, 64,000 people canoed the Pine. This intensity of use per stream mile is 10 times that of the popular Boundary Waters Canoe Area in Northern Minnesota (Superior National Forest 1972). Data on canoeist numbers were very limited until recent years. However, the trend is believed to be reasonably accurate because it generally follows the number of available rental canoes for which there is much better data. Rentals comprise 90 percent of the canoes on the river and thus strongly influence the total number of people canoeing (Solomon and Hansen 1972).

STREAMBANK EROSION

Judging streambank-erosion changes by both categorizing them and using photos gave essentially the same results. Likewise, both observers indicated the same trend in streambank condition. The photos showed a slightly higher percentage of bank changes because even small changes were evident.

Of the initial 204 eroding banks identified in 1966, 15 were judged to be healed (a completely vegetated waterline) in 1973. Offsetting this were 15 new eroding banks that began primarily from massive slumping during wet weather. These new points of erosion started in steep, although well-forested areas that had little or no human traffic on them

The banks were revegetating naturally (table 2). This conclusion is admittedly based on subjective judgment. However, the vegetation changes were usually striking enough that there was little doubt about the overall trend (fig. 1). Only a few banks lost vegetation and in those cases the changes were relatively minor.

Table 2.--*Streambank stability in 1973 compared to 1966 as judged by two observers* [1]

(In numbers of banks)

Observer	More stable	Unchanged	Less stable
A	23	21	4
B	29	10	9

[1]Waterline vegetation was used as an index of stability. Judgments were based on original photo records of 48 banks.

IMPLICATIONS

Over this 8-year observation period, streambank erosion was in apparent equilibrium in spite of an increase in flood flows and a large increase in canoeing. As many streambanks healed naturally as there were new points of erosion. Other banks that are gradually revegetating will probably eventually heal, thus offsetting new areas of bank erosion. There was no evidence that streambank erosion was accelerating, even with the large increases in canoeing.

Two canoeing-associated activities do tend to increase streambank erosion: sliding down steep sand banks (Taube 1967), and the upsurge of "wilderness" camping. Sliding is limited to relatively few banks (about five on the Pine). Several of these banks near campgrounds are probably also

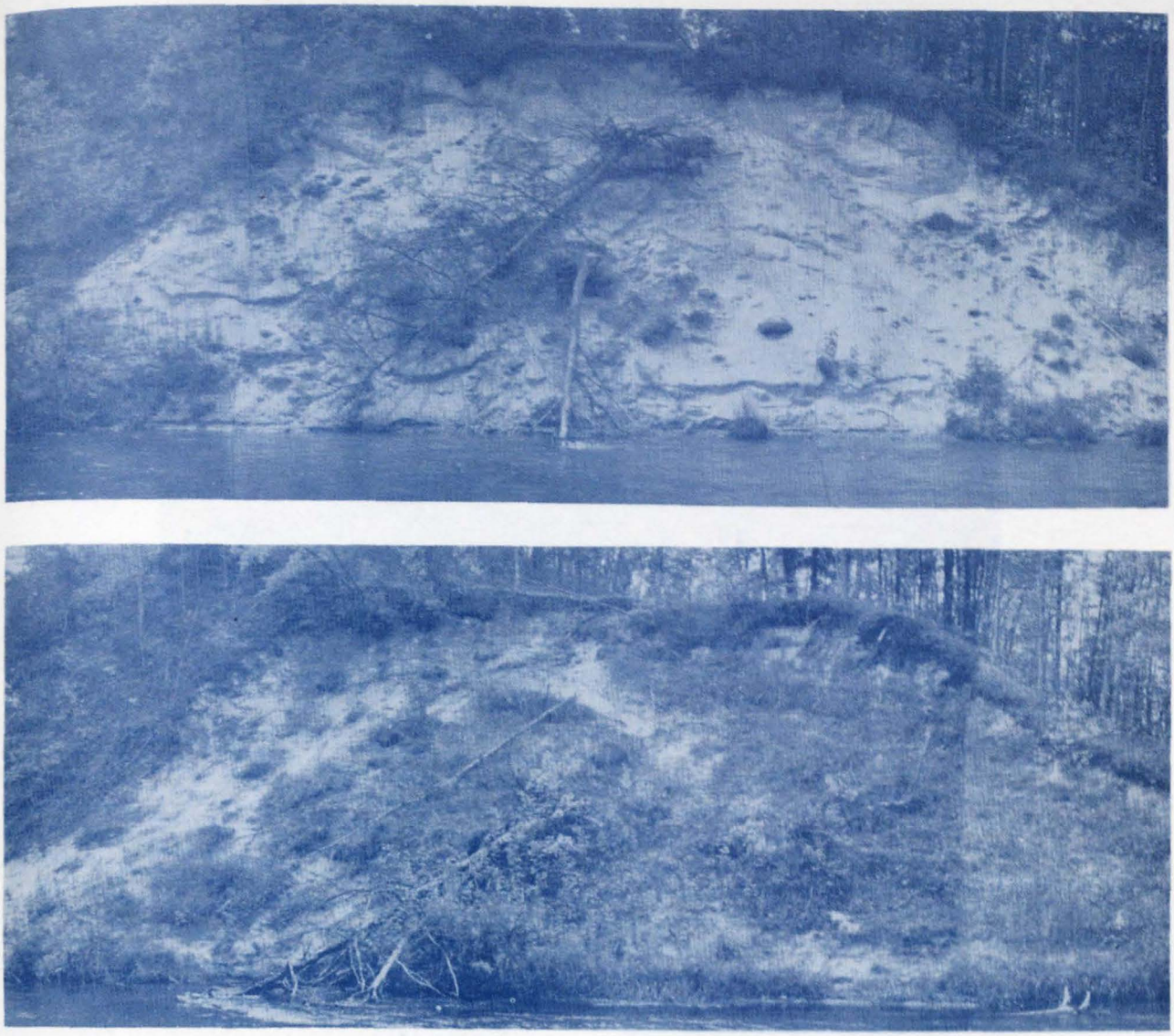

Figure 1.--*Natural revegetation of an eroding bank. More than a quarter million people canoed past the bank between the two photo dates. No effort was made to stabilize the bank. Top photo taken in August 1967; botton photo taken in September 1973.*

used for sliding by noncanoeists (fig. 2). Camping has depleted streambank vegetation at landing points (fig. 3). These campsites are usually on low flood plains and erosion of the devegetated banks appears minimal.

In conclusion, it appears that the passage of large numbers of canoes does not have any observable effect on streambank erosion. Only when canoeists stop and camp or walk on banks does erosion begin. This man-induced erosion is minor to date compared to the extensive naturally occurring erosion. To minimize streambank erosion by canoeists, management need not be overly concerned with density of canoe traffic. Rather, management should restrict streambank use by people.

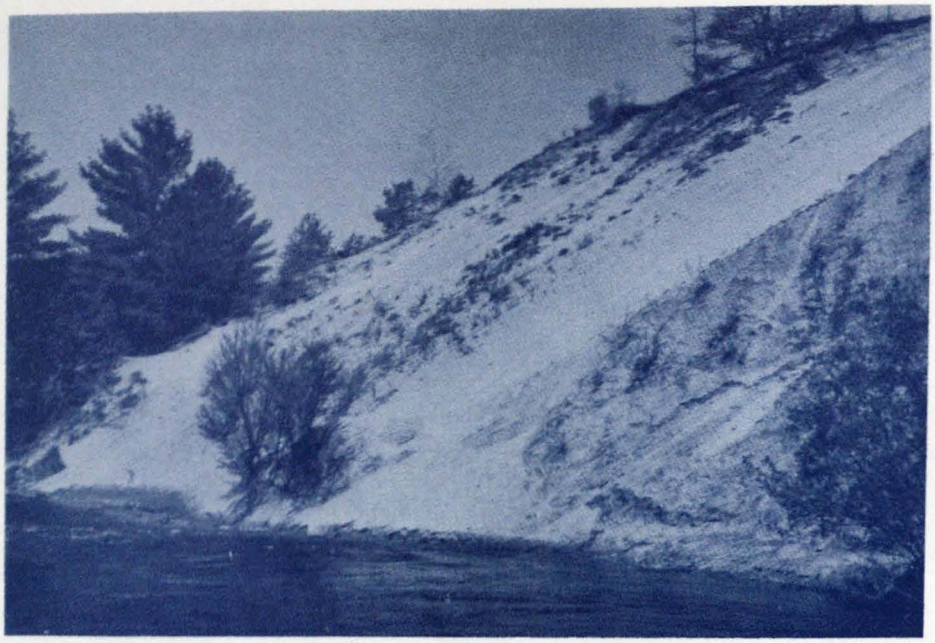

Figure 2.--*A few steep banks are used as "sand slides" by canoeists, campers, and other stream visitors.*

Figure 3.--*Camping by canoeists causes deterioration of landing points and campsites.*

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